



APPLICATION NO. 09/846.410

TITLE OF INVENTION: Multiple Data Rate Complex Hybrid Walsh Codes  
for CDMA

5 INVENTORS: Urbain A. von der Embse

## CLAIMS

10 WHAT IS CLAIMED IS:

1. A means for the implementation of new fast algorithms  
for complex Walsh orthogonal CDMA encoding and decoding of  
multiple data rate users over a CDMA frequency band with  
properties which

15 provide a complex Walsh orthogonal code with the real  
component equal to the real Walsh orthogonal code, and with the  
imaginary component equal to a reordering of the real Walsh  
orthogonal code which makes the complex Walsh orthogonal code the  
correct complex version of the real Walsh orthogonal code to  
20 within arbitrary angle rotations and scale factors

provide complex Walsh orthogonal CDMA codes which reduce to  
the real Walsh orthogonal CDMA codes upon removal of the  
imaginary code components

25 provide a means to encode and decode multiple data rate  
users with complex Walsh orthogonal codes for simultaneous  
transmission over the same CDMA frequency band with  
computationally efficient algorithm means to implement the  
encoding and decoding

30 provide a computationally efficient algorithm means to  
encode and decode multiple data rate users with complex Walsh  
orthogonal codes with values  $+/- 1$   $+/- j$ , for simultaneous  
transmission over the same CDMA frequency band

p.1 claim amendments to application 09/846,410

In line 1-2 please add the underlined words and delete the strikethrough word

In line 8 please add the underlined word

In lines 11-32 please delete the strikethrough text for the cancelled Claim 1

p.2 claim amendments to application 09/846,410

In lines 1-15 please delete the strikethrough text for the  
cancelled Claim **2**

p. 3 claim amendments to application 09/846,410

In lines 1-19 please delete the strikethrough text for the  
cancelled Claim **3**

2. A means for the implementation of new hybrid complex Walsh orthogonal CDMA encoding and decoding of multiple data rate users over a CDMA frequency band with properties

provide a means for the construction of hybrid complex  
5 Walsh orthogonal CDMA codes which are functional combinations of the complex Walsh, discrete Fourier transform (DFT), Hadamard (real Walsh), and other orthogonal codes and which offer wider choices of code lengths

provide a means to extend the complex Walsh orthogonal CDMA  
10 codes to include the complex discrete Fourier transform (DFT) codes and other orthogonal codes to allow greater flexibility in the choices for the code lengths

provide new fast algorithm means for the encoding and decoding of hybrid complex Walsh codes for multiple data rate  
15 users

20

25

30

35

3. A means for the design of hybrid complex Walsh orthogonal CDMA encoding and decoding of multiple data rate users over a CDMA frequency band with properties

provide a means to provide greater flexibility in the  
5 selection of the code length by combining the complex Walsh orthogonal CDMA codes with the complex DFT orthogonal CDMA codes as well as with other orthogonal codes

provide a Kronecker product means to combine the complex Walsh orthogonal CDMA codes with complex DFT orthogonal CDMA  
10 codes as well as with other orthogonal CDMA codes

provide a direct sum means to combine the complex Walsh orthogonal CDMA codes with complex DFT orthogonal CDMA codes as well as with other orthogonal CDMA codes

provide a functionality means to combine the complex Walsh orthogonal CDMA codes with complex DFT orthogonal CDMA codes as well as with other orthogonal CDMA codes

provide new fast algorithm means for the encoding and decoding of hybrid complex Walsh codes for multiple data rate users

20

25

30

35

p. 4 claim amendments to application 09/846,410

In lines 1-19 please delete the strikethrough text for the  
cancelled Claim **4**

4. A means to provide unconstrained flexibility in the selection of the code length by functional combining of appropriate orthogonal CDMA codes drawn from a set of code candidates that include the complex Walsh and the complex DFT

5 provide a functional means for the generation of orthogonal CDMA codes with unconstrained flexibility in the selection of the code length

10 provide a fast algorithm means for the encoding and decoding of CDMA codes designed with a functional means for the generation of orthogonal CDMA codes with unconstrained flexibility in the selection of the code length

15 provide a functional means for the generation of orthogonal CDMA codes for multiple data rate users with unconstrained flexibility in the selection of the code length

20 provide a fast algorithm means for multiple data rate encoding and decoding of orthogonal CDMA codes which are generated by a functional means for multiple data rate users to provide unconstrained flexibility in the selection of the code length

25

30

35

p. 5 claim amendments to application 09/846,410

In lines 1-34 please add the underlined text for the new **Claim 5**

5 5. A method for the design and implementation of fast encoders and fast decoders for Hybrid Walsh and generalized Hybrid Walsh complex orthogonal CDMA channelization codes for multiple data rate users over a frequency band with properties

5

Hybrid Walsh inphase (real axis) codes and quadrature (imaginary axis) codes are defined by lexicographic reordering permutations of the Walsh code

10 Hybrid Walsh codes have a 1-to-1 sequency~frequency correspondence with the DFT codes and have a 1-to-1 even~cosine and odd~sine correspondences with the DFT codes

15 Hybrid Walsh codes take values {1+j, -1+j, -1-j, 1-j} or equivalently take values {1, j, -1, -j} with a (-45) rotation of axes and a renormalization

20 generalized Hybrid Walsh codes can be constructed for a wide range of code lengths by combining Hybrid Walsh with DFT (discrete Fourier transform), Hadamard and other orthogonal codes, and quasi-orthogonal PN codes using tensor product, direct product, and functional combining

25 fast encoding and fast decoding implementation algorithms are defined

30 algorithms are defined to map multiple data rate user data symbols onto the code input data symbol vector for fast encoding and the inverses of these algorithms are defined for recovery of the data symbols with fast decoding

encoders perform complex multiply encoding of complex data to replace the current Walsh real multiply encoding of inphase and quadrature data

35

p. 6 claim amendments to application 09/846,410

In lines 1-3 please add the underlined text for the new **Claim 5**

decoders perform complex conjugate transpose multiply  
decoding of complex data to replace the current Walsh real  
multiply decoding of inphase and quadrature data

5

10

15

20

25

30

p. 7 claim amendments to application 09/846,410

In lines 1-30 please add the underlined text for the new Claim 6

6. A method for the design and implementation of encoders and decoders for complex orthogonal CDMA and generalized complex orthogonal CDMA channelization codes for multiple data rate users over a frequency band with properties

5

complex codes inphase (real axis) codes and quadrature (imaginary axis) codes are defined by reordering permutations of the real Walsh codes

10 generalized complex codes can be constructed for a wide range of code lengths by combining the complex codes with DFT (discrete Fourier transform), Hybrid Walsh, Hadamard and other orthogonal codes, and quasi-orthogonal PN codes using tensor product, direct product, and functional combining

15

fast encoding and fast decoding implementation algorithms are defined

20 algorithms are defined to map multiple data rate user data symbols onto the code input data symbol vector for fast encoding and the inverses of these algorithms are defined for recovery of the data symbols with fast decoding

25 encoders perform complex multiply encoding of complex data to replace the current Walsh real multiply encoding of inphase and quadrature data

30 decoders perform complex conjugate transpose multiply decoding of complex data to replace the current Walsh real multiply decoding of inphase and quadrature data